(12) DEMANDE INTERNATIONALE PUBLIÉE EN VERTU DU TRAITÉ DE COOPÉRATION EN MATIÈRE DE BREVETS (PCT)

(19) Organisation Mondiale de la Propriété Intellectuelle
Bureau international

(43) Date de la publication internationale
17 juillet 2003 (17.07.2003)

PCT

(10) Numéro de publication internationale
WO 03/058349 A2

(51) Classification internationale des brevets[7] : G03F 7/20

(21) Numéro de la demande internationale :
PCT/FR03/00037

(22) Date de dépôt international : 8 janvier 2003 (08.01.2003)

(25) Langue de dépôt : français

(26) Langue de publication : français

(30) Données relatives à la priorité :
02/00329 11 janvier 2002 (11.01.2002) FR

(71) Déposant *(pour tous les États désignés sauf US)* : **MACDERMID GRAPHIC ARTS S.A.** [FR/FR]; F-68700 Steinbach (FR).

(72) Inventeurs; et
(75) Inventeurs/Déposants *(pour US seulement)* : **KUCZYNSKI, Jerzy** [FR/FR]; 9, rue de Chanoine Secret, F-68720 Zillisheim (FR). **RICH, Gérard** [FR/FR]; 1, rue des Peupliers, F-68500 Orschwihr (FR).

(74) Mandataire : **BERGER, Helmut**; Cabinet Weinstein, 56A, rue du Faubourg Saint-Honoré, F-75008 Paris (FR).

(81) États désignés *(national)* : AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) États désignés *(régional)* : brevet ARIPO (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), brevet eurasien (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), brevet européen (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, SI, SK, TR), brevet OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Publiée :
— *sans rapport de recherche internationale, sera republiée dès réception de ce rapport*

En ce qui concerne les codes à deux lettres et autres abréviations, se référer aux "Notes explicatives relatives aux codes et abréviations" figurant au début de chaque numéro ordinaire de la Gazette du PCT.

(54) Title: METHOD FOR THE PRODUCTION OF A FLEXOGRAPHIC PLATE AND FLEXOGRAPHIC PLATE OBTAINED ACCORDING TO SAID METHOD

(54) Titre : PROCEDE DE FABRICATION D'UNE PLAQUE DE FLEXOGRAPHIE ET PLAQUE DE FLEXOGRAPHIE OBTENUE PAR CE PROCEDE

(57) Abstract: The invention relates to a method for producing a flexographic plate comprising a base layer and a layer of photosensitive material fixed on the base layer. According to the inventive method, an image is produced on the photosensitive layer by means of selective reticulation, whereby the areas to be reticulated are exposed to light of a predefined wavelength and the non-reticulated areas are removed. The inventive method is characterized by the use of amplitude-modified laser light with a wavelength ranging from 390 to 410, which scans the surface of the photosensitive layer. The inventive method can be used to produce flexographic plates.

(57) Abrégé : L'invention concerne un procédé de fabrication d'une plaque de flexographie comportant une couche de base et une couche d'un matériau photosensible fixé sur la couche de base. Le procédé est du type selon lequel on produit une image sur la couche photosensible en provoquant une réticulation sélective par insolation des zones à réticuler par la lumière d'une longueur d'ondes prédéterminée et par enlèvement des zones non réticulées. Le procédé est caractérisé en ce que l'on utilise pour l'insolation une lumière laser, modulée en amplitude, dont la longueur d'ondes est de l'ordre de 390 à 410 nm et qui est amenée à balayer la surface de la couche photosensible. L'invention est utilisable pour la fabrication de plaques de flexographie.

WO 03/058349 A2

"Procédé de fabrication d'une plaque de flexographie et plaque de flexographie obtenue par ce procédé".

L'invention concerne un procédé de fabrication d'une plaque de flexographie, notamment par moyens digitaux, comportant sur une couche de base, une couche d'un matériau photosensible, du type selon lequel on produit une image sur la couche photosensible en provoquant une réticulation sélective par insolation des zones à réticuler par de la lumière d'une longueur d'onde prédéterminée et par enlèvement des zones non réticulées. L'invention concerne également une plaque de flexographie obtenue selon ce procédé.

Des procédés et des plaques de flexographie de ce type sont déjà connues. Un procédé connu de réalisation d'une plaque de flexographie consiste à insoler en lumière ultraviolette un photopolymère de nature élastomérique à travers un masque opaque à cette lumière ultraviolette. Ce procédé présente l'inconvénient que le masque est réalisé de façon digitale par ablation sélective in situ d'une couche superficielle opaque aux UV avec un laser opérant en lumière infrarouge.

Selon un autre procédé on réalise l'image par écriture directe des plaques de photopolymères à l'aide de sources ultraviolettes modulées en amplitude. Ces sources peuvent être des lasers opérant à des longueurs d'ondes de 350 à 370 nm typiquement. Ces sources présentent les inconvénients majeurs d'être d'un coût exorbitant , d'avoir un rendement énergétique faible et des puissances disponibles également faibles, d'utiliser des optiques ayant des pertes de puissance et d'être d'une maintenance coûteuse.

Encore un autre procédé connu implique l'utilisation de photopolymères sensibles à la lumière visible avec par exemple des technologies de base

Argentique comme les pellicules photo. Ce procédé est fort contraignant car il nécessite des mesures de protection rigoureuse contre la lumière du jour.

L'invention a pour but de proposer un procédé qui pallie les inconvénients qui viennent d'être exposés.

Pour atteindre ce but, le procédé selon l'invention est caractérisé en ce que l'on utilise pour la réalisation de l'image une lumière laser, modulée en amplitude, dont la longueur d'ondes est de l'ordre de 390 à 410 nm, et qui est amenée à balayer la surface de la plaque.

Selon une caractéristique de l'invention, on utilise des sources laser constituées d'un faisceau de diodes fonctionnant à des longueurs d'ondes autour de 405 nm.

Selon une caractéristique de l'invention, l'enlèvement des zones non réticulées est effectué par fluidification de ces zones par voie thermique, sans utilisation de solvants.

L'agencement de plaque de flexographie selon l'invention est caractérisé en ce qu'il présente la forme d'un manchon tubulaire sur un support rigide, qui comporte une base composite et, fixée sur cette base, une couche en un matériau photosensible exempte de solvants.

L'invention sera mieux comprise, et d'autres buts, caractéristiques, détails et avantages de celle-ci apparaîtront plus clairement dans la description qui va suivre faite en référence aux dessins schématiques annexés donnés uniquement à titre d'exemple illustrant un mode de réalisation de l'invention et dans lesquels :

- la figure 1 est une vue schématique en coupe radiale de l'agencement de plaque de flexographie en forme d'un manchon selon l'invention ;

- la figure 2 est une vue en coupe, radiale avec arrachement, et à plus grande échelle, d'un autre mode de réalisation de l'agencement de plaque flexographique selon l'invention, et

- la figure 3 est une vue en perspective d'encore un autre mode de réalisation de l'agencement de plaque de flexographie selon l'invention.

Une plaque de flexographie selon l'invention se présente avantageusement sous forme d'un manchon tubulaïre 1 monté sur un support rigide 2 connu en soi. La plaque 1 comporte une base composite 4 d'épaisseur adaptée, comprise entre environ 0,2 mm et 40 mm, de préférence de 0,3 mm, et une couche d'un matériau photosensible 5 d'épaisseur comprise entre environ 0,5 et 2 mm, de préférence de 1,5 mm, qui est fixée sur la face extérieure de la base 4. Ce manchon peut être fabriqué en utilisant un procédé d'extrusion ou tout autre procédé connu en soi. Selon une autre variante, il pourrait être réalisé par projection thermique de poudre formulée au préalable sur un cylindre ou manchon de support par exemple en un matériau composite ou tout autre matériau approprié.

Il est à noter que la surface extérieure de la couche photosensible peut être usinée et polie pour assurer un respect strict des dimensions.

Selon l'invention, l'image sur la couche photosensible est réalisée par inscription directe à l'aide d'une lumière ayant une longueur d'ondes dans une une gamme de l'ordre de 390 à 410 nm environ, qui est émise par un laser modulé en amplitude par un logiciel et qui balaye la surface de la plaque. Ainsi la lumière utilisée se situe entre la frontière du visible et de l'ultraviolet. De préférence, la source laser est constituée d'un faisceau de diodes fonctionnant à des longueurs d'ondes autour de 405 nm.

Comme matière photosensible, sensible à une telle lumière laser on utilise des matériaux comportant un ou deux ou plusieurs polymères de haut poids moléculaire, des monomères ou oligomères fonctionnalisés, des photo initiateurs, des diluants réactifs ou non, des inhibiteurs et agents de protection et des pigments. Les

diluants et les oligomères permettent généralement d'ajuster la viscosité.

Les photoinitiateurs utilisés doivent bien entendu être sensibles à la lumière utilisée. On pourrait envisager, à titre d'exemple les photoinitiateurs disponibles dans le commerce sous des noms commerciaux Irgacure 819 et 1850 de Ciba, Génocure CQ de Rahn, Darocure TPO de Ciba, TPO lucirin de BASF, Génocure TPO de Rahn et Quantacure CPTX de Rahn.

Le photopolymère utilisé peut disposer de deux ou plusieurs systèmes de réticulation complémentaires, à savoir un système principal servant à créer l'image et un système complémentaire pour compléter la réticulation et augmenter la tenue chimique et mécanique. Un autre système pourrait générer des compressibilités différentes. Un tel système est décrit dans le document FR 2 803 245.

Les photopolymères utilisés peuvent être pré-réticulés partiellement pour ajuster la viscosité et éviter le fluage à froid lors des périodes de stockage prolongées ou des transports. Il est encore à noter que le photopolymère pourrait être sensibilisé par un flash de lumière avant le traitement laser pour augmenter l'efficacité de celui-ci.

De façon préférée, un photopolymère sensible à la lumière laser utilisée dans le cadre de l'invention est un matériau à base de SBS ou contenant du SBS, du SIS ou encore en SEBS et d'une dureté comprise entre environ 60 et 70 ShA.

Une autre particularité de l'invention réside dans le fait que, de préférence, le lavage des zones non réticulées par exposition à la lumière laser est effectué par un procédé thermique connu en soi et décrit dans le document US 3 264 103. A cette fin le manchon est réchauffé à une température assurant la fluidification des zones non réticulées, ce qui permet l'élimination de ces zones sans solvants. A cette fin, la matière non

réticulée par la lumière laser pourrait être spécialement formulée par des moyens connus en soi pour avoir une variation forte de viscosité à une température comprise entre 60 et 140 °C. Des plages de viscosité nécessaires à un développement thermique dans de bonnes conditions entrent en phase solide entre 10 000 et 1 000 000 de centipoises en en phase fluide de développement en dessous de 1000 centipoises.

Il est encore à noter que l'énergie nécessaire à l'insolation est avantageusement comprise entre 20 et 1000 mJ/cm^2.

Les diluants qui peuvent aussi être réactifs, envisagés, à titre d'exemples, sont les suivants, en utilisant les noms abrégés des molécules et en les classant en deux familles distinctes :

Mono-acrylates et mono-méthacrylates de différent poids moléculaire aliphatiques et fonctionnalisés : HEA, HPA, EMA, IBMA, HMA, I-DMA, EMMA, C13MA, C17.4MA, IBOA, HPMA ;

Uréthanes acrylates, diacrylates et diméthacrylates de différents poids moléculairse aliphatiques et fontionnalisés : HDDA, TEGDA, TTEGDA, TPGDA, NPGDA, BDDMA, DEGDMA, HDDMA, PG200DMA, N-IBMMAA, GDMA.

Uréthanes, acrylates, acrylates et méthacrylates multifonctionnels de type : TMPTA, TMPTMA, DTMPTA, DPEMPA.

L'invention telle que décrite présente de nombreux avantages. Ainsi la réalisation des manchons d'une part, et la création de l'image, d'autre part, peuvent être effectuées très rapidement, avec un repérage parfait et sans intermédiaire d'un film intermédiaire. La longueur d'ondes de la lumière laser utilisée, plus faible que la lumière employée jusqu'à présent, assure une plus grande résolution spatiale. La possibilité de développer le manchon sans solvant procure l'avantage très important de protéger l'environnement Enfin, l'utilisation d'une

lumière dans une bande de longueur d'ondes comprise en 390 et 410 nm permet d'utiliser des diodes lasers très performantes 4 et d'un coût d'acquisition et de maintenance relativement faible. Des photoinitiateurs sensibles à cette longueur d'ondes sont disponibles en grand nombre. Les contraintes de protection contre la lumière du jour sont limitées. A ces longueurs d'ondes des optiques de faisceau laser utilisées sont simples. La réticulation directe selon l'invention présente l'avantage de nécessiter moins d'énergie que l'ablation qui est une technologie concurrente de réalisation digitale.

Le manchon selon l'invention tel qu'il est décrit en se référant à la figure 1 peut être complété par ajout d'autres couches, comme cela a déjà été mentionné plus haut, pour obtenir des agencements de plaque de flexographie plus complexes.

Ainsi la figure 2 montre un agencement dans lequel une couche compressible 6 telle que décrite dans le brevet français N° 2 805 245 est interposée entre la couche photosensible 5 comprenant l'image en relief représentée en 7 et la base composite 4.

La figure 3 illustre la possibilité d'utiliser, de la manière et pour des raisons décrites dans le documents EP 0 711 665 un manchon intercalaire 8 en un matériau polymère entre le support 2 et le manchon 1 formé par la base 4 et la couche photosensible 5.

Ci-avant on a décrit, à titre d'exemple de la mise en œuvre de l'invention, un agencement de plaque de flexographie, dans lequel cette plaque est réalisée sous forme d'un manchon tubulaire. Bien entendu l'agencement peut aussi être obtenu par enroulement et fixation de plaques sur des cylindres ou des manchons de support.

Il est à noter que de multiple modifications peuvent être apportées à l'invention telle qu'elle vient d'être décrite à titre d'exemple. En effet, il est possible d'utiliser plusieurs lasers qui agissent en

parallèle. La plaque de flexographie peut avoir une base en film polyester à la place du support rigide. Cette plaque peut comporter deux ou plusieurs couches de matériaux photosensibles et elle peut être gravable avec de l'eau ou avec une solution aqueuse sous pression, à température élevée ou par simple brossage.

REVENDICATIONS

1. Procédé de fabrication d'une plaque de flexographie comportant une couche de base et une couche d'un matériau photosensible fixé sur la couche de base, du type selon lequel on produit une image sur la couche photosensible en provoquant une réticulation sélective par insolation des zones à réticuler par la lumière d'une longueur d'ondes prédéterminée et par enlèvement des zones non réticulées, caractérisé en ce que l'on utilise pour l'insolation une lumière laser, modulée en amplitude, dont la longueur d'ondes est de l'ordre de 390 à 410 nm et qui est amenée à balayer la surface de la couche photosensible.

2. Procédé selon la revendication 1, caractérisé en ce que l'on utilise des sources laser constituées d'un faisceau de diodes fonctionnant à des longueur d'ondes autour de 405 nm.

3. Procédé selon l'une des revendications 1 ou 2, caractérisé en ce que l'enlèvement des zones non réticulées est effectué par fluidification de ces zones par voie thermique, sans utilisation de solvants.

4. Procédé selon la revendication 3, caractérisé en ce que l'on utilise un matériau photosensible formulé de façon que la matière non réticulée par la lumière laser ait une variation forte de viscosité à une température avantageusement comprise entre 60 et 140°C, et que la matière des zones réticulées soit totalement infusible à cette température ou devienne fusible à une température nettement plus élevée que la température de variation de viscosité.

5. Procédé selon l'une des revendications 1 à 4, caractérisé en ce que le matériau photosensible comporte un ou deux ou plusieurs polymères de haut poids moléculaire, des monomères ou oligomères fonctionnalisés, des photo-initiateurs, des diluants réactifs ou non, des

inhibiteurs et agents de protection et, le cas échéant, des pigments.

6. Procédé selon l'une des revendications 1 à 5, caractérisé en ce que le matériau photosensible est un photopolymère comprenant au moins deux systèmes de réticulation complémentaires.

7. Procédé selon la revendication 6, caractérisé en ce qu'un système principal sert à créer l'image.

8. Procédé selon la revendication 6 ou 7, caractérisé en ce qu'un système complémentaire est utilisé pour compléter la réticulation et augmenter la tenue chimique et mécanique.

9. Procédé selon l'une des revendications 6 à 8, caractérisé en ce qu'un système complémentaire est utilisé pour générer des compressibilités différentes.

10. Procédé selon l'une des revendications 6 à 9, caractérisé en ce que le photopolymère est susceptible d'être pré-réticulé partiellement pour ajuster la viscosité ou éviter le fluage à froid lors des périodes de stockage prolongées ou des transports.

11. Procédé selon l'une des revendications 6 à 10, caractérisé en ce que le photopolymère est susceptible d'être sensibilisé par un flash de lumière avant l'inscription de l'image par laser, pour augmenter l'efficacité de cette inscription.

12. Procédé selon l'une des revendications 1 à 11, caractérisé en ce que le matériau sensible précité est un polymère ayant une dureté comprise entre 60 et 70 ShA environ.

13. Procédé selon l'une des revendications 1 à 12, caractérisé en ce que l'énergie employée pour l'insolation est comprise entre 20 et 1000 mJ/cm^2.

14. Procédé selon l'une des revendications 1 à 13, caractérisé en ce que la plaque est obtenue par projection thermique de poudres formulées au préalable sur un manchon de support.

15. Procédé selon l'une des revendications 1 à 14, caractérisé en ce que l'on utilise plusieurs lasers agissant en parallèle.

16. Agencement de plaque de flexographie obtenu selon l'une des revendications 1 à 15, caractérisé en ce qu'il présente la forme d'un manchon tubulaire (1) sur un support rigide, qui comporte une base composite (4) et, fixée sur cette bas, une couche en un matériau photosensible (5) exempte de solvants.

17. Agencement selon la revendication 16, caractérisé en ce que la base composite (4) a une épaisseur comprise entre environ 0,2 à 40 mm, de préférence de 0.3 mm.

18. Agencement selon l'une des revendications 16 ou 17, caractérisé en ce que la couche de matériau photosensible (5) a une épaisseur comprise entre 0.5 mm et 2 mm, de préférence de 1.5mm.

19. Agencement selon l'une des revendications 16 à 18, caractérisé en ce que le manchon (1) comporte une couche compressible (6).

20. agencement selon l'une des revendications 16 à 19, caractérisé en ce qu'au manchon (1) est associé un manchon comportant une couche intercalaire (8) de variation de l'épaisseur du manchon.

21. Agencement selon la revendication 20, caractérisé en ce que la couche intercalaire (8) est compressible.

22. Agencement selon l'une des revendications 16 à 21, caractérisé en ce que le manchon tubulaire (1) est réalisé par extrusion.

23. Agencement selon l'une des revendications 16 à 21, caractérisé en ce que le manchon tubulaire (1) est obtenu par enroulement et fixation d'une plaque sur un cylindre ou manchon de support.

24. Agencement selon l'une des revendications 16 à 21, caractérisé en ce que le manchon tubulaire (1) est un manchon obtenu par projection thermique de poudres

formulées au préalable sur un cylindre ou un manchon de support.

25. Agencement selon l'une des revendications 16 à 24, caractérisé en ce que le support rigide est formé par une base en film polyester de la plaque de flexographie;

26. Agencement selon l'une des revendications 16 à 25, caractérisé en ce que la plaque de flexographie (1) comporte une pluralité de couches de matériau photosensible.

27. Agencement selon l'une des revendications 16 à 26, caractérisé en ce que la plaque de flexographie (1) est gravable avec de l'eau ou avec une solution aqueuse sous pression, à température élevée ou par simple brossage.

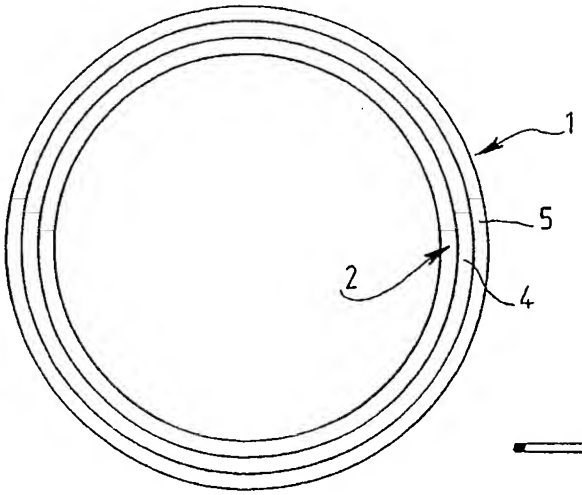

Fig. 1

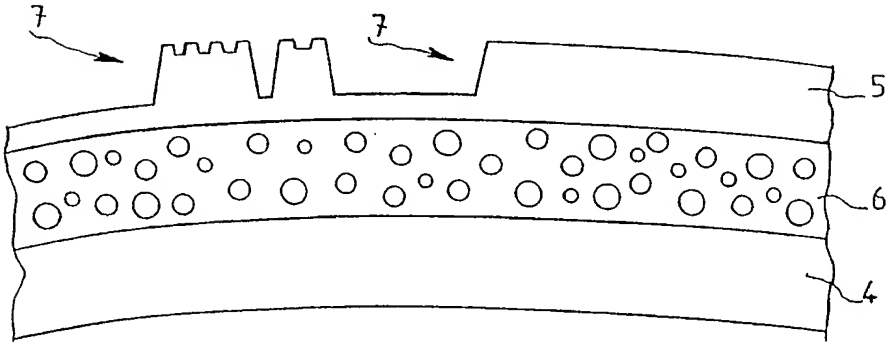

Fig. 2

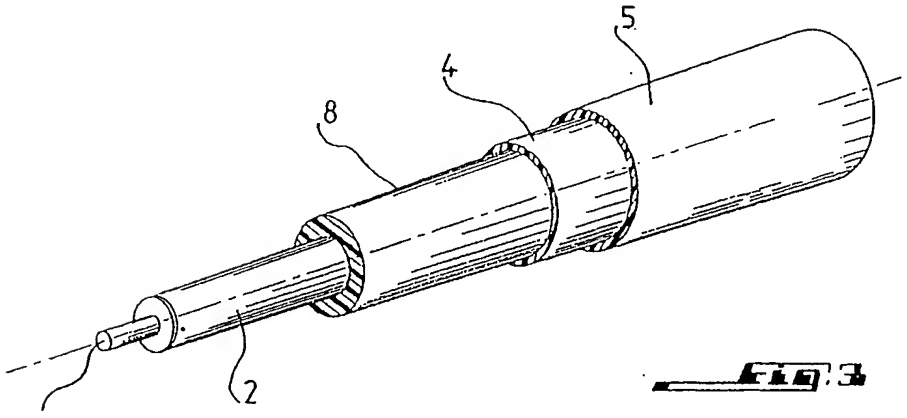

Fig. 3

TRANSLATION

(12) INTERNATIONAL APPLICATION PUBLISHED IN ACCORDANCE WITH THE PATENT COOPERATION TREATY (PCT)

(19) International Organization for Intellectual Property
International Bureau

(43) Date of international publication
July 17, 2003 (17.07.2003)

(10) Number of international publication
WO 03/058349 A2

(51) International patent classification[7] :
G03F 7/20

(21) International application number :
PCT/FR03/00037

(22) International application date :
January 8, 2003 (08.01.2003)

(25) Application language : French

(26) Publication language : French

(30) Information relative to priority :
02/00329 January 11, 2002 (11.01.2002) FR

(71) Applicant *(for all states except US)* : **MACDERMID GRAPHIC ARTS S.A. [FR/FR]**; F-68700 Steinbech (FR)

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* :**KUCZYNSKI, Jerzy [FR/FR]**; 9, rue de Chanoine Secret, F-68720, Zillisheim (FR)
RICH, Gerard [FR/FR]; 1, rue des Peupliers, F-68500 Orschwihr (FR).

(74) Agent : **BERGER, Helmut**; Cabinet Weinstein 56A, rue du Faubourg Saint-Honore, F-75008 Paris (FR).

(81) Designated States *(national)* : AE, AG, AL, AM, AT, AU, AZ, BA ,BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published :
- Without international search report

With respect to the two letter codes and other abbreviations, refer to the "Explanation notes relative to codes and abbreviations" at the beginning of each issue of the PCT Gazette

(54) Title: PROCESS FOR PRODUCING A FLEXOGRAPHIC PLATE AND FLEXOGRAPHIC PLATE OBTAINED BY SAID PROCESS

(57) **Abstract** : The invention relates to a process for producing a flexographic plate comprising a base layer and a layer of photosensitive material bonded to the base layer. The process is of the type in which an image is produced on the photosensitive layer by selective crosslinking, wherein the areas to be crosslinked are exposed to a light of predetermined wavelength and the non-crosslinked areas are removed. The process is characterized by the use of amplitude-modulated laser light with a wavelength of the order of 390 to 410 nm which scans the surface of the photosensitive layer. The invention can be used to produce flexographic plates.

"Process for producing a flexographic plate and flexographic plate obtained by said process"

The invention relates to a process for producing a flexographic plate, notably by digital means, comprising a base layer and a layer of photosensitive material bonded to the base layer, of the type in which an image is produced on the photosensitive layer by selective crosslinking, wherein the areas to be crosslinked are exposed to a light of predetermined wavelength and the non-crosslinked areas are removed. The invention also relates to a flexographic plate produced by said process.

Flexographic processes and plates of this type are already known. One known process for producing a flexographic plate consists in exposing an elastomeric photopolymer with ultraviolet light through a mask which is opaque to this ultraviolet light. This process has the drawback that the mask is obtained in a digital manner by selective in situ ablation of a surface layer which is opaque to UV using a laser operating in the infrared range.

According to another process, the image is formed by direct writing on photopolymer plates using amplitude-modulated sources of ultraviolet light. These sources can be lasers operating typically at wavelengths of 350 to 370 nm. These sources present the major drawback of having exorbitant costs, of having low energy yields and also low power, of using optics with large power losses and of being costly to maintain.

Still another known process involves the use of photopolymers which are sensitive to visible light with, for example, silver based technologies for the photographic films. This process suffers from the constraint that it requires rigorous protective measures against daylight.

The objective of the present invention is to propose a process which overcomes the drawbacks cited.

In order to achieve this goal, the process of the invention is characterized in that the image is produced using an amplitude-modulated laser light whose wavelength is of the order of 390 to 410 nm which scans the surface of the plate.

According to a characteristic of the invention, the laser sources are constituted from a beam of diodes operating at wavelengths around 405 nm.

According to a characteristic of the invention, the removal of the non-crosslinked areas is effected by fluidification of these areas by thermal means, without the use of solvents.

The arrangement of the flexographic plate of the invention is characterized in that it is in the form of a tubular sleeve on a rigid support, comprising a composite base and a solvent-free layer of photosensitive material bonded to said base.

The invention will be better understood, and other characteristics, details and advantages will become clearer from the following description made with reference to the attached schematic drawings provided only as an example illustrating an embodiment of the invention in which :

- figure 1 is a schematic view shown as a radial cross section of the arrangement of the flexographic plate of the invention in the form of a sleeve;

- figure 2 is a view, in radial cross section with part removed, on a larger scale, of another embodiment of the arrangement of the flexographic plate of the invention, and

- figure 3 is a view, in perspective, of still another arrangement of the flexographic plate of the invention.

The flexographic plate of the invention is advantageously in the form of a tubular sleeve 1 mounted on a rigid support 2 which is known per se. The plate 1 comprises a composite base 4 of appropriate thickness, comprised between about 0.2 m and 40 mm, preferably 0.3 mm, and a layer of photosensitive material 5 of thickness comprised between 0.5 and 2 mm, preferably 1.5 mm, bonded to the external surface of the base 4. This sleeve can be manufactured using an extrusion process or any other known process. According to one variant, it can be produced by thermal spraying of a pre-formulated powder onto a support cylinder or sleeve, for example said powder being from a composite material or any other appropriate material.

It is noted that the external surface of the photosensitive layer can be machined and polished to meet strict dimensional requirements.

According to the invention, the image on the photosensitive layer is produced by direct inscription using light having a wavelength in the range of about 390 to 410 nm, emitted by a laser whose amplitude is modulated by software which scans the plate surface. Thus, the light used is located at the border between the visible and ultraviolet regions. Preferably the laser source is constituted from a beam of diodes operating at wavelengths around 405 nm.

The photosensitive material used, which is sensitive to such a laser light, is a material comprising one or two or more high molecular weight polymers, functionalized monomers or oligomers, photo-initiators, reactive or non-reactive diluants, inhibitors, protective agents and pigments. The diluants and the oligomers make it possible to adjust the viscosity.

The photo-initiators used must of course be sensitive to the light used. Examples of these are the commercially available photo-initiators under the tradenames Irgacure 819 and 1850 from Ciba, Genocure CQ from Rahn, Darocure TPO from Ciba, TPO lucirin from BASF, Genocure TPO from Rahn and Quantacure CPTX from Rahn.

The photopolymer used can contain two or more complementary crosslinking systems, namely a principal system serving to form the image and a complementary system to complete the crosslinking and increase the chemical and mechanical resistance. Another system could generate different compressibilities. Such as system is described in document FR 2 803 245.

The photopolymers used can be partially pre-crosslinked to adjust the viscosity and prevent cold flow during extended storage or in shipping. It can also be noted that the photopolymer can be sensitized using a light flash before the laser treatment to increase the latter's efficiency.

Preferably, a photopolymer sensitive to laser light used within the scope of this invention is a material based on SBS or containing SBS, SIS or SEBS having a hardness comprised between about 60 and 70 Sha.

Another particularity of the invention is the fact that, preferably, washing of the areas not crosslinked by exposure to the laser light is effected by a thermal process known per se and described in document US 3 264 103. To this end, the sleeve is heated to a temperature which insures fluidification of the non-crosslinked areas, which allows elimination of these areas without the use of a solvent. To this end, the material not crosslinked by the laser light can be specially formulated by known means to have a large viscosity variation at a temperature comprised between 60 and 140°C. Viscosity ranges necessary to a good thermal development are going from the solid phase between 10,000 and 1,000,000 centipoises to a fluid development phase of 1000 centipoises.

It should also be noted that the energy required for exposure is advantageously comprised between 20 and 1000 mJ/cm^2.

The diluants, which may also be reactive, considered as examples are the following, using the abbreviations for their chemical molecules and they are classified into two distinct families :

Functionalized aliphatic monoacrylates and monomethacrylates of different molecular weights : HEA, HPA, EMA, IBMA, HMA, I-DMA, EMMA, C13MA, C17.4MA, IBOA, HPMA;

Functionalized aliphatic urethanes, acrylates, diacrylates and dimethacrylates of different molecular weights : HDDA, TEGDA, TTEGDA, TPGDA, NPGDA, BDDMA, DEGDMA, HDDMA, PG200DMA, N-IBMMAA, GDMA;

Multifunctional urethanes, acrylates, diacrylates and methacrylates of the type : TMPTA, TMPTMA, DTMPTA, DPEMPA.

The invention such as described presents numerous advantages. Thus fabrication of the sleeves and creation of the image can be effected very rapidly, with perfect location and without the use of an intermediate film. The wavelength of the laser light used, lower than that of light used until now, ensures a larger spatial resolution. The capability of developing the sleeve without the use of solvents provides the very important advantage of protecting the environment. Finally, the use of light within the wavelength range comprised between 390 and 410 nm makes it possible to use high performance laser diodes. 4 which are of relatively low acquisition and maintenance cost. Photoinitiators which are sensitive to this wavelength are widely available. The constraints imposed by needing protection against daylight are limited. At these wavelengths, the optics needed for the laser beam are simple. Direct crosslinking according to the invention has the advantage of requiring less energy that ablation which is a current competing digital technology.

The sleeve of the invention, as described in figure 1 can be completed by addition of other layers, as mentioned above, to obtain more complex flexographic plate arrangements.

Thus, figure 2 shows an arrangement in which a compressible layer 6, such as described in French patent N° 2 805 245, is placed between the photosensitive layer 5 comprising the image in relief represented as 7 and the composite base 4.

Figure 3 illustrates the possibility of using, for reasons described in document EP 0 711 665, an intermediary sleeve 8 made from a polymeric material between the support 2 and the sleeve 1 formed by the base 4 and the photosensitive layer 5.

In the preceding description, the example of an embodiment of the invention involved an arrangement for a flexographic plate in which the plate is produced in the form of a tubular sleeve. It is understood that the arrangement can also be obtained by winding and fixing plates onto support cylinders or sleeves.

It should be noted that many modifications can be made to the invention as described as an example. Thus, it is possible to use several lasers which act in parallel. The flexographic plate can have a base of polyester film in place of the rigid support. This plate can comprise two or more layers of photosensitive materials and it can be engraved with water or with an aqueous solution under pressure, at elevated temperature or by simple brushing.

CLAIMS

1) Process for producing a flexographic plate comprising a base layer and a layer of photosensitive material bonded to the base layer, of the type in which an image is produced on the photosensitive layer by selective crosslinking, wherein the areas to be crosslinked are exposed to a light of predetermined wavelength and the non-crosslinked areas are removed, characterized in that an amplitude-modulated laser light is used for the exposure having a wavelength of the order of 390 to 410 nm which scans the surface of the photosensitive layer.

2) Process according to claim 1, characterized in that said laser sources are constituted from a beam of diodes operating at wavelengths around 405 nm.

3) Process according to any of the claims 1 or 2, characterized in that the removal of said non-crosslinked areas is effected by fluidification of these areas by thermal means, without the use of solvents.

4) Process according to claim 3, characterized in that the photosensitive material used is formulated so that the material not crosslinked by the laser light has a large viscosity variation at a temperature advantageously comprised between 60 and 140°C, and in that the material in the crosslinked areas is completely non-meltable at this temperature or begins to melt at a temperature significantly higher than the temperature of viscosity variation.

5) Process according to any of the claims 1 to 4, characterized in that said photosensitive material comprises one or two or more high molecular weight polymers, functionalized monomers or oligomers, photo-initiators, reactive or non-reactive diluants, inhibitors, protective agents and, if need be, pigments.

6) Process according to any of the claims 1 to 5, characterized in that said photosensitive material is a photopolymer comprising two or more complementary crosslinking systems.

7) Process according to claim 6, characterized in that a principal system serves to form the image.

8) Process according to claim 6 or 7, characterized in that a complementary system is used to complete the crosslinking and increase the chemical and mechanical resistance.

9) Process according to any of the claims 6 to 8, characterized in that a complementary system is used to generate different compressibilities.

10) Process according to any of the claims 6 to 9, characterized in that said photopolymer can be partially pre-crosslinked to adjust the viscosity or avoid cold flow during extended storage or in shipping.

11) Process according to any of the claims 6 to 10, characterized in that said photopolymer is capable of being sensitized using a light flash before inscription of the image by laser, to increase the inscription efficiency.

12) Process according to any of the claims 1 to 11, characterized in that said sensitive material is a polymer having a hardness comprised between about 60 and 70 Sha.

13) Process according to any of the claims 1 to 12, characterized in that the energy required for exposure is comprised between 20 and 1000 mJ/cm^2.

14) Process according to any of the claims 1 to 13, characterized in that said plate is produced by thermal spraying of a pre-formulated powder onto a support cylinder or sleeve.

15) Process according to any of the claims 1 to 14, characterized in that several lasers which act in parallel are used.

16) Flexographic plate arrangement obtained according to any of he claims 1 to 15, characterized in that it is present in the form of a tubular sleeve (1) mounted on a rigid support which comprises a composite base (4) and a layer of solvent-free photosensitive material (5) bonded to said base.

17) Arrangement according to claim 16, characterized in that the composite base (4) has a thickness comprised between about 0.2 m and 40 mm, preferably 0.3 mm.

18) Arrangement according to any of the claims 16 or 17, characterized in that the layer of photosensitive material (5) has a thickness comprised between 0.5 and 2 mm, preferably 1.5 mm.

19) Arrangement according to any of the claims 16 to 18, characterized in that the sleeve (1) comprises a compressible layer (6).

20) Arrangement according to any of the claims 16 to 19, characterized in that a sleeve comprising an intermediary layer (8) is associated to the sleeve (1) to vary the thickness of said sleeve.

21) Arrangement according to claim 20, characterized in that said intermediary layer (8) is compressible.

22) Arrangement according to any of the claims 16 to 21, characterized in that said tubular sleeve (1) is produced by extrusion.

23) Arrangement according to any of the claims 16 to 22, characterized in that said tubular sleeve (1) is obtained by winding and bonding a plate onto a support cylinder or sleeve.

24) Arrangement according to any of the claims 16 to 21, characterized in that said tubular sleeve (1) is obtained by thermal spraying of pre-formulated powders onto a support cylinder or sleeve.

25) Arrangement according to any of the claims 16 to 24, characterized in that said rigid support is formed by a polyester film base on the flexographic plate.

26) Arrangement according to any of the claims 16 to 25, characterized in that said flexographic plate (1) comprises a plurality of photosensitive material layers.

27) Arrangement according to any of the claims 16 to 26, characterized in that said flexographic plate (1) can be engraved with water or with an aqueous solution under pressure, at elevated temperature or by simple brushing.

Translation : Language Services
Running Fox Technologies, Inc.
A. Z. Fresco : 11/25/03

1/1

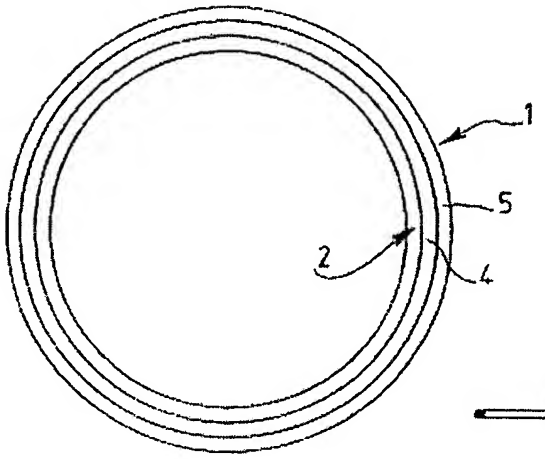

Fig. 1

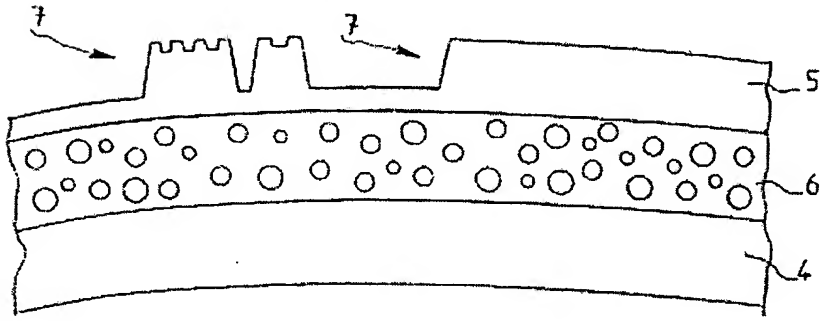

Fig. 2

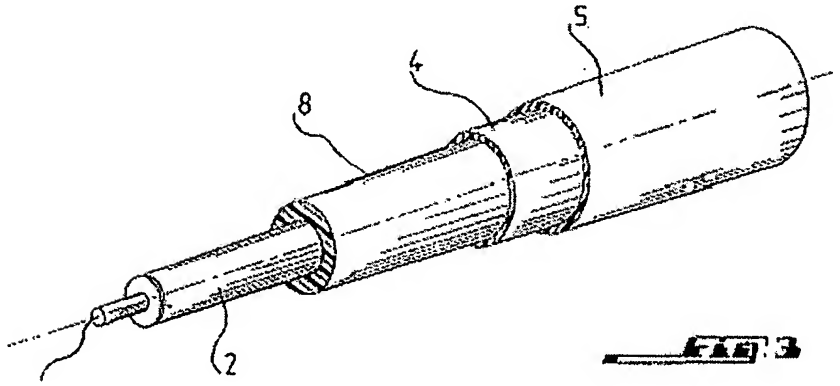

Fig. 3

TRANSLATION

(12) INTERNATIONAL APPLICATION PUBLISHED IN ACCORDANCE WITH THE PATENT COOPERATION TREATY (PCT)

(19) International Organization for Intellectual Property
International Bureau

(43) Date of international publication
July 17, 2003 (17.07.2003)

(10) Number of international publication
WO 03/058349 A2

(51) International patent classification[7] :
G03F 7/20

(21) International application number :
PCT/FR03/00037

(22) International application date :
January 8, 2003 (08.01.2003)

(25) Application language : French

(26) Publication language : French

(30) Information relative to priority :
02/00329 January 11, 2002 (11.01.2002) FR

(71) Applicant *(for all states except US)* : **MACDERMID GRAPHIC ARTS S.A. [FR/FR]**; F-68700 Steinbech (FR)

(72) Inventors; and
(75) Inventors/Applicants *(for US only)* :**KUCZYNSKI, Jerzy [FR/FR]**; 9, rue de Chanoine Secret, F-68720, Zillisheim (FR)
RICH, Gerard [FR/FR]; 1, rue des Peupliers, F-68500 Orschwihr (FR).

(74) Agent : **BERGER, Helmut**; Cabinet Weinstein 56A, rue du Faubourg Saint-Honore, F-75008 Paris (FR).

(81) Designated States *(national)* : AE, AG, AL, AM, AT, AU, AZ, BA ,BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SK, SL, TJ, TM, TN, TR, TT, TZ UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published :
- Without international search report

With respect to the two letter codes and other abbreviations, refer to the "Explanation notes relative to codes and abbreviations" at the beginning of each issue of the PCT Gazette

(54) Title: PROCESS FOR PRODUCING A FLEXOGRAPHIC PLATE AND FLEXOGRAPHIC PLATE OBTAINED BY SAID PROCESS

(57) **Abstract** : The invention relates to a process for producing a flexographic plate comprising a base layer and a layer of photosensitive material bonded to the base layer. The process is of the type in which an image is produced on the photosensitive layer by selective crosslinking, wherein the areas to be crosslinked are exposed to a light of predetermined wavelength and the non-crosslinked areas are removed. The process is characterized by the use of amplitude-modulated laser light with a wavelength of the order of 390 to 410 nm which scans the surface of the photosensitive layer. The invention can be used to produce flexographic plates.

"Process for producing a flexographic plate and flexographic plate obtained by said process"

The invention relates to a process for producing a flexographic plate, notably by digital means, comprising a base layer and a layer of photosensitive material bonded to the base layer, of the type in which an image is produced on the photosensitive layer by selective crosslinking, wherein the areas to be crosslinked are exposed to a light of predetermined wavelength and the non-crosslinked areas are removed. The invention also relates to a flexographic plate produced by said process.

Flexographic processes and plates of this type are already known. One known process for producing a flexographic plate consists in exposing an elastomeric photopolymer with ultraviolet light through a mask which is opaque to this ultraviolet light. This process has the drawback that the mask is obtained in a digital manner by selective in situ ablation of a surface layer which is opaque to UV using a laser operating in the infrared range.

According to another process, the image is formed by direct writing on photopolymer plates using amplitude-modulated sources of ultraviolet light. These sources can be lasers operating typically at wavelengths of 350 to 370 nm. These sources present the major drawback of having exorbitant costs, of having low energy yields and also low power, of using optics with large power losses and of being costly to maintain.

Still another known process involves the use of photopolymers which are sensitive to visible light with, for example, silver based technologies for the photographic films. This process suffers from the constraint that it requires rigorous protective measures against daylight.

The objective of the present invention is to propose a process which overcomes the drawbacks cited.

In order to achieve this goal, the process of the invention is characterized in that the image is produced using an amplitude-modulated laser light whose wavelength is of the order of 390 to 410 nm which scans the surface of the plate.

According to a characteristic of the invention, the laser sources are constituted from a beam of diodes operating at wavelengths around 405 nm.

According to a characteristic of the invention, the removal of the non-crosslinked areas is effected by fluidification of these areas by thermal means, without the use of solvents.

The arrangement of the flexographic plate of the invention is characterized in that it is in the form of a tubular sleeve on a rigid support, comprising a composite base and a solvent-free layer of photosensitive material bonded to said base.

The invention will be better understood, and other characteristics, details and advantages will become clearer from the following description made with reference to the attached schematic drawings provided only as an example illustrating an embodiment of the invention in which :

- figure 1 is a schematic view shown as a radial cross section of the arrangement of the flexographic plate of the invention in the form of a sleeve;

- figure 2 is a view, in radial cross section with part removed, on a larger scale, of another embodiment of the arrangement of the flexographic plate of the invention, and

- figure 3 is a view, in perspective, of still another arrangement of the flexographic plate of the invention.

The flexographic plate of the invention is advantageously in the form of a tubular sleeve 1 mounted on a rigid support 2 which is known per se. The plate 1 comprises a composite base 4 of appropriate thickness, comprised between about 0.2 m and 40 mm, preferably 0.3 mm, and a layer of photosensitive material 5 of thickness comprised between 0.5 and 2 mm, preferably 1.5 mm, bonded to the external surface of the base 4. This sleeve can be manufactured using an extrusion process or any other known process. According to one variant, it can be produced by thermal spraying of a pre-formulated powder onto a support cylinder or sleeve, for example said powder being from a composite material or any other appropriate material.

It is noted that the external surface of the photosensitive layer can be machined and polished to meet strict dimensional requirements.

According to the invention, the image on the photosensitive layer is produced by direct inscription using light having a wavelength in the range of about 390 to 410 nm, emitted by a laser whose amplitude is modulated by software which scans the plate surface. Thus, the light used is located at the border between the visible and ultraviolet regions. Preferably the laser source is constituted from a beam of diodes operating at wavelengths around 405 nm.

The photosensitive material used, which is sensitive to such a laser light, is a material comprising one or two or more high molecular weight polymers, functionalized monomers or oligomers, photo-initiators, reactive or non-reactive diluants, inhibitors, protective agents and pigments. The diluants and the oligomers make it possible to adjust the viscosity.

The photo-initiators used must of course be sensitive to the light used. Examples of these are the commercially available photo-initiators under the tradenames Irgacure 819 and 1850 from Ciba, Genocure CQ from Rahn, Darocure TPO from Ciba, TPO lucirin from BASF, Genocure TPO from Rahn and Quantacure CPTX from Rahn.

The photopolymer used can contain two or more complementary crosslinking systems, namely a principal system serving to form the image and a complementary system to complete the crosslinking and increase the chemical and mechanical resistance. Another system could generate different compressibilities. Such as system is described in document FR 2 803 245.

The photopolymers used can be partially pre-crosslinked to adjust the viscosity and prevent cold flow during extended storage or in shipping. It can also be noted that the photopolymer can be sensitized using a light flash before the laser treatment to increase the latter's efficiency.

Preferably, a photopolymer sensitive to laser light used within the scope of this invention is a material based on SBS or containing SBS, SIS or SEBS having a hardness comprised between about 60 and 70 Sha.

Another particularity of the invention is the fact that, preferably, washing of the areas not crosslinked by exposure to the laser light is effected by a thermal process known per se and described in document US 3 264 103. To this end, the sleeve is heated to a temperature which insures fluidification of the non-crosslinked areas, which allows elimination of these areas without the use of a solvent. To this end, the material not crosslinked by the laser light can be specially formulated by known means to have a large viscosity variation at a temperature comprised between 60 and 140°C. Viscosity ranges necessary to a good thermal development are going from the solid phase between 10,000 and 1,000,000 centipoises to a fluid development phase of 1000 centipoises.

It should also be noted that the energy required for exposure is advantageously comprised between 20 and 1000 mJ/cm^2.

The diluants, which may also be reactive, considered as examples are the following, using the abbreviations for their chemical molecules and they are classified into two distinct families :

Functionalized aliphatic monoacrylates and monomethacrylates of different molecular weights : HEA, HPA, EMA, IBMA, HMA, I-DMA, EMMA, C13MA, C17.4MA, IBOA, HPMA;

Functionalized aliphatic urethanes, acrylates, diacrylates and dimethacrylates of different molecular weights : HDDA, TEGDA, TTEGDA, TPGDA, NPGDA, BDDMA, DEGDMA, HDDMA, PG200DMA, N-IBMMAA, GDMA;

Multifunctional urethanes, acrylates, diacrylates and methacrylates of the type : TMPTA, TMPTMA, DTMPTA, DPEMPA.

The invention such as described presents numerous advantages. Thus fabrication of the sleeves and creation of the image can be effected very rapidly, with perfect location and without the use of an intermediate film. The wavelength of the laser light used, lower than that of light used until now, ensures a larger spatial resolution. The capability of developing the sleeve without the use of solvents provides the very important advantage of protecting the environment. Finally, the use of light within the wavelength range comprised between 390 and 410 nm makes it possible to use high performance laser diodes 4 which are of relatively low acquisition and maintenance cost. Photoinitiators which are sensitive to this wavelength are widely available. The constraints imposed by needing protection against daylight are limited. At these wavelengths, the optics needed for the laser beam are simple. Direct crosslinking according to the invention has the advantage of requiring less energy that ablation which is a current competing digital technology.

The sleeve of the invention, as described in figure 1 can be completed by addition of other layers, as mentioned above, to obtain more complex flexographic plate arrangements.

Thus, figure 2 shows an arrangement in which a compressible layer 6, such as described in French patent N° 2 805 245, is placed between the photosensitive layer 5 comprising the image in relief represented as 7 and the composite base 4.

Figure 3 illustrates the possibility of using, for reasons described in document EP 0 711 665, an intermediary sleeve 8 made from a polymeric material between the support 2 and the sleeve 1 formed by the base 4 and the photosensitive layer 5.

In the preceding description, the example of an embodiment of the invention involved an arrangement for a flexographic plate in which the plate is produced in the form of a tubular sleeve. It is understood that the arrangement can also be obtained by winding and fixing plates onto support cylinders or sleeves.

It should be noted that many modifications can be made to the invention as described as an example. Thus, it is possible to use several lasers which act in parallel. The flexographic plate can have a base of polyester film in place of the rigid support. This plate can comprise two or more layers of photosensitive materials and it can be engraved with water or with an aqueous solution under pressure, at elevated temperature or by simple brushing.

CLAIMS

1) Process for producing a flexographic plate comprising a base layer and a layer of photosensitive material bonded to the base layer, of the type in which an image is produced on the photosensitive layer by selective crosslinking, wherein the areas to be crosslinked are exposed to a light of predetermined wavelength and the non-crosslinked areas are removed, characterized in that an amplitude-modulated laser light is used for the exposure having a wavelength of the order of 390 to 410 nm which scans the surface of the photosensitive layer.

2) Process according to claim 1, characterized in that said laser sources are constituted from a beam of diodes operating at wavelengths around 405 nm.

3) Process according to any of the claims 1 or 2, characterized in that the removal of said non-crosslinked areas is effected by fluidification of these areas by thermal means, without the use of solvents.

4) Process according to claim 3, characterized in that the photosensitive material used is formulated so that the material not crosslinked by the laser light has a large viscosity variation at a temperature advantageously comprised between 60 and 140°C, and in that the material in the crosslinked areas is completely non-meltable at this temperature or begins to melt at a temperature significantly higher than the temperature of viscosity variation.

5) Process according to any of the claims 1 to 4, characterized in that said photosensitive material comprises one or two or more high molecular weight polymers, functionalized monomers or oligomers, photo-initiators, reactive or non-reactive diluants, inhibitors, protective agents and, if need be, pigments.

6) Process according to any of the claims 1 to 5, characterized in that said photosensitive material is a photopolymer comprising two or more complementary crosslinking systems.

7) Process according to claim 6, characterized in that a principal system serves to form the image.

8) Process according to claim 6 or 7, characterized in that a complementary system is used to complete the crosslinking and increase the chemical and mechanical resistance.

9) Process according to any of the claims 6 to 8, characterized in that a complementary system is used to generate different compressibilities.

10) Process according to any of the claims 6 to 9, characterized in that said photopolymer can be partially pre-crosslinked to adjust the viscosity or avoid cold flow during extended storage or in shipping.

11) Process according to any of the claims 6 to 10, characterized in that said photopolymer is capable of being sensitized using a light flash before inscription of the image by laser, to increase the inscription efficiency.

12) Process according to any of the claims 1 to 11, characterized in that said sensitive material is a polymer having a hardness comprised between about 60 and 70 Sha.

13) Process according to any of the claims 1 to 12, characterized in that the energy required for exposure is comprised between 20 and 1000 mJ/cm^2.

14) Process according to any of the claims 1 to 13, characterized in that said plate is produced by thermal spraying of a pre-formulated powder onto a support cylinder or sleeve.

15) Process according to any of the claims 1 to 14, characterized in that several lasers which act in parallel are used.

16) Flexographic plate arrangement obtained according to any of he claims 1 to 15, characterized in that it is present in the form of a tubular sleeve (1) mounted on a rigid support which comprises a composite base (4) and a layer of solvent-free photosensitive material (5) bonded to said base.

17) Arrangement according to claim 16, characterized in that the composite base (4) has a thickness comprised between about 0.2 m and 40 mm, preferably 0.3 mm.

18) Arrangement according to any of the claims 16 or 17, characterized in that the layer of photosensitive material (5) has a thickness comprised between 0.5 and 2 mm, preferably 1.5 mm.

19) Arrangement according to any of the claims 16 to 18, characterized in that the sleeve (1) comprises a compressible layer (6).

20) Arrangement according to any of the claims 16 to 19, characterized in that a sleeve comprising an intermediary layer (8) is associated to the sleeve (1) to vary the thickness of said sleeve.

21) Arrangement according to claim 20, characterized in that said intermediary layer (8) is compressible.

22) Arrangement according to any of the claims 16 to 21, characterized in that said tubular sleeve (1) is produced by extrusion.

23) Arrangement according to any of the claims 16 to 22, characterized in that said tubular sleeve (1) is obtained by winding and bonding a plate onto a support cylinder or sleeve.

24) Arrangement according to any of the claims 16 to 21, characterized in that said tubular sleeve (1) is obtained by thermal spraying of pre-formulated powders onto a support cylinder or sleeve.

25) Arrangement according to any of the claims 16 to 24, characterized in that said rigid support is formed by a polyester film base on the flexographic plate.

26) Arrangement according to any of the claims 16 to 25, characterized in that said flexographic plate (1) comprises a plurality of photosensitive material layers.

27) Arrangement according to any of the claims 16 to 26, characterized in that said flexographic plate (1) can be engraved with water or with an aqueous solution under pressure, at elevated temperature or by simple brushing.

Translation : Language Services
Running Fox Technologies, Inc.
A. Z. Fresco : 11/25/03

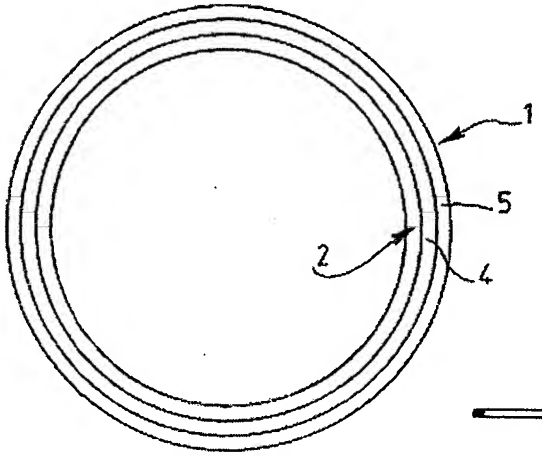

Fig. 1

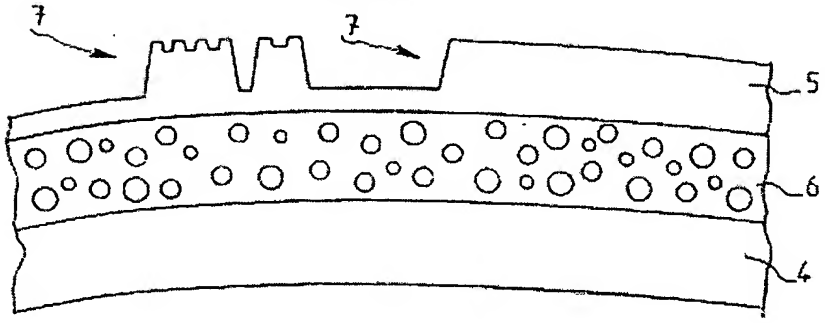

Fig. 2

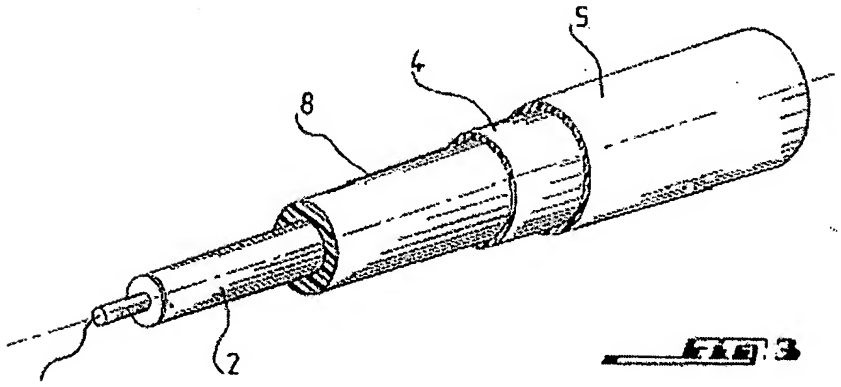

Fig. 3